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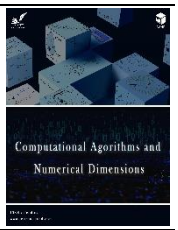

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Crop Growth Monitoring Through integration of WSN and IoT

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Abstract

The emerging and revolutionary technology called Internet of Things (IoT), presenting the future of computing, communication, and network, has made a number of tough jobs easier with the help of Internet, sensor, and embedded systems. Agriculture is said to be the backbone of Indian Economy and is of utmost importance in the present scenario. Today's agriculture is data-centered, precise, and smarter than ever. The research paper explores the various issue and challenges which are vital in the field of smart agriculture using IoT devices. The paper also highlights the importance and usefulness of wireless network and other related terminology in this area. The paper explores the various advances in the field of smart agriculture, IoT, and wireless network and draws attention to the various future research directions that the research community can take to further improve the system in terms of economics, operations, and technical feasibility.

Keywords: Wireless sensor networks, Agriculture, Precision agriculture, Internet of things, Bibliometrics.

1 | Introduction

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Agriculture is taken into account as it is the basis of life for human species, as it is the main supply of food grains and alternative raw materials. Growth in agricultural sector is important for the event of status of the country [1]. The advancement within the technology can facilitate farmers to increase the crop gain. The new ideas within the technologies currently are day area unit; 1) Internet of Things (IoT), and 2) Wireless Sensor Network (WSN). The utilization of wireless sensing element network collects the info from differing kinds of sensors and sends it to main server victimization wireless protocol [2]. After grouping the info from the server, necessary actions do not like activating the motor from the webpage nor by is machine-controlled done, which saves the human work [3]. The idea of the IoT 1st came in to style in 1999, through the Auto-ID Center at Massachusetts Institute of Technology and connected market-analysis publications. IoT, the thought of obtaining real-world objects are connected with one another and consumes info [4]. The IoT permits objects to be detected or controlled remotely across existing network infrastructure.

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IoT is predicted to supply advanced property of devices, systems, and services that goes beyond Machine-to-Machine (M2M), consultants' estimate that IoT can encompass concerning thirty billion objects by 2020 [5]. Likewise, it is possible to integrate IoT into the agricultural system to make it smart and secure. Lots of work has been carried out in this field in the recent past; however, with improvised IoT architecture which may be feasible, viable, and achievable and clubbed with WSN technology, one can expect a better version of it [6].

2 | Literature Review

IoT is not just a technology but an ecosystem of technologies or amalgamation of different sets of technology that can have a profound impact on our lives personal, professional and social. According to study [7] Robots have been used in the agriculture field for efficiency which leads to high cost [8]. In this, more advanced technique is used which is use of insecticides and pesticides that can be used for the growth of crops [9] Growth in agricultural sector is necessary for the development of economic condition of the country. Unfortunately, many farmers still use the traditional methods of farming which results in low yielding of crops and fruits [9]. The sensors have deployed in the fields for the collection of data about the environment, humidity, soil moisture and leaf wetness. For the collection of data remote agriculture sensor board is used because it is specially designed for handling agriculture activities [10]. Wherever automation had been implemented and human beings had been replaced by automatic machineries, the yield has been improved. Hence there is need to implement modern science and technology in the agriculture sector for increasing the yield [11]. According to the survey, in earlier days the farmer has to method the entire sector connected work like observing the sector for condition and checking the water level manually which it ends up in complexness [12]. Once the farmer manually monitors the sector, it ends up in force and additional time consumption. Thanks to the decrease in water for the sector results in loss for the farmer [13]. We will bring the agriculture to subsequent level by victimization the most recent technologies like IoT and WSN [14].

3 | Methodology

The methodology that used in this research is network development life cycle. The methodology consists of analysis, design, simulation prototyping, implementation, monitoring and management [15].

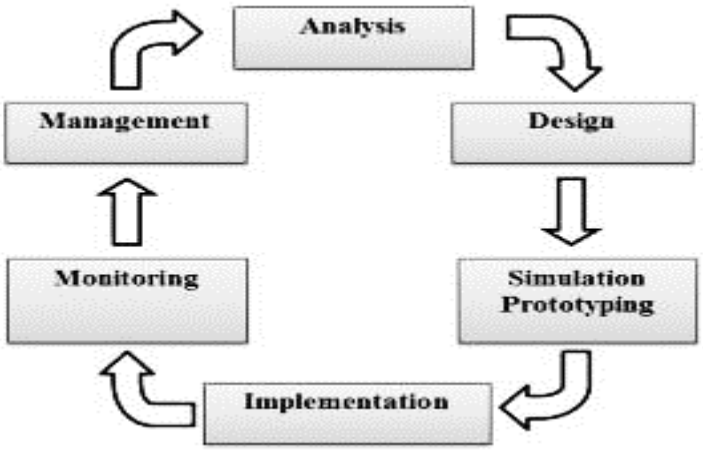

Fig. 1. Life cycle of smart agriculture

4 | Analysis

The problems in this research were analyzed and to measure the requirement needed. The problem was the connectivity between the database and the microcontrollers were unavailable. The WSN for smart

farming optimization can be used to monitor the farm from the distance and able to store the data into the database [16].

5 | Design

The network topology design was created. By creating the design of the network topology and the interconnection between the database and the sensor the system can provide reliable data from the farm. The designs created were include the network topology, the data access design and cabling [17].

6 | Simulation

After the analysis and the design phase, the next phase is to simulate using cisco packet tracer to test the readiness of the system for implementation.

7 | Implementation

In the implementation phase everything that has been done were implemented. The implementation phase will determine the result weather a failure or a success. The implementation phase was dividing as follow:

I. The sensor process while activated produced the output as data to send to the database [18].
II. Wireless router as communication media from sensors [19].
III. The server computer will receive the data through WSN to store into the database and can be viewed via website [20].

8 | Monitoring

The monitoring phase is to see the reliability condition of the system, the flow of the transmitted packet in the network and the stability of the connection [21].

9 | Management

The management phase is to manage the network so the WSN communication among all devices can be maintained.

10 | Proposed Work

India is the world's largest producer of sugarcane. Of the several agricultural crops, sugarcane s most remunerative crop and has a very high economy biomass to total biomass ratio. Its requirement for water and fertilizer are equally high. Sugarcane roots may extends to 90cm depth and grows extremely well medium to heavy, well drained, soil of pH 7.5 to 8.5 and high organic matter content [22]. Heat, humidity and sunlight plays important role in sugarcane germination, tillering, vegetative growth and maturity. Sugarcane grows well in humid and hot weather it require humidity of 70% for more vegetative growth [23].

According to *Table 1*, it is clear that growth of sugar cane crop is highly dependent on few climatic factors like air temperature, humidity, and soil temperature and soil moisture. So it is essential to monitor few climatic conditions for the better yield of sugarcane. This paper would take the opportunity to design an instrument that is able to monitor the ait temperature, humidity, and soil temperature and air moisture of an agricultural field and transmit it to a remote receiver outside the field. The system represented in this paper is composed of the microcontroller, WSN base station with GSM module, Data collecting nodes, device control node and mobile phone. The WSN data collecting node is connected with

temperature, soil moisture and humidity sensor. When these sensor nodes find an abnormal or unsuitable environment condition of the soil the nodes will send encoded alarm signal to base station. Once the base station receives an alarm signal, it will send a SMS to farmer through the GSM module and GSM network immediately.

Table 1. Stages of agriculture with parameters.

	Air Temperature	Soil Temperature	Soil Moisture	Humidity
Sprouting	Optimum 26-33deg.C. Minimum-18degC	Optimum 23-28deg.C. Minimum-19degC	Initiated by water	-
Tillering	Assisted by cool nights	Less if soil is warm	Helped by sufficient moisture in soil	-
Growth	Optimum at 30-33degC, poor<20degC	Optimum 23-29deg.C. Poor＜21degC	Adequate moisture essential	Better in humid air
Flowering	Warm nights helps, halted by few nights at 18degC	Maximum in warm soil	Optimum in moist soil, halted by drought	Some humidity is required
Ripening	Prompted by cold nights, optimum＜15degC	Best at low temperature	Prompted by lack of moisture	Better in very dry climate
Over ripening	Prompted by return of hot season	Helped by increase in temperature	Prompted by water being Available after a dry period.	-

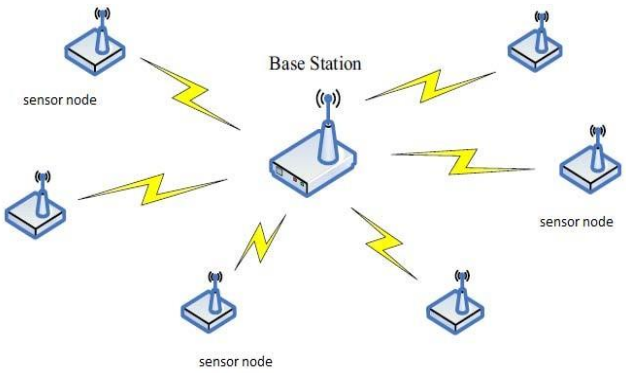

Fig. 2. Structure of wireless sensor network.

11 | Conclusion

During this project the sensors and Node-MCU area unit with success interfaced and wireless communication is achieved between varied nodes. All observations and experimental tests prove that this

project may be a complete resolution to field activities. Implementation of such a system with in the field will undoubtedly facilitate to enhance the yield of the crops and overall production. As a crucial constituent a part of the IoT, sensing element networks to act with the world objects. We have a tendency to area unit managing the sensing element network style that allows connecting agriculture to the IoT. The affiliation sets up the links among farms, and therefore improves the assembly of agricultural product, it's a comprehensive system designed to attain preciseness in agriculture. All observations and experimental tests proves that project may be a complete resolution to field activities, irrigation issues, and storage issues victimization remote controlled automaton, sensible irrigation system and a sensible warehouse management system severally. Implementation of such a system within the field will undoubtedly facilitate to enhance the yield of the crops and overall production.

References

[1] Mohapatra, H., & Rath, A. K. (2020). Fault-tolerant mechanism for wireless sensor network. *IET wireless sensor systems*, *10*(1), 23-30.

[2] Mohapatra, H., & Rath, A. K. (2019). Fault tolerance in WSN through PE-LEACH protocol. *IET wireless sensor systems*, *9*(6), 358-365.

[3] Mohapatra, H., & Rath, A. K. (2019). Detection and avoidance of water loss through municipality taps in India by using smart taps and ICT. *IET wireless sensor systems*, *9*(6), 447-457.

[4] Mohapatra, H., & Rath, A. K. (2020). Survey on fault tolerance-based clustering evolution in WSN. *IET networks*, *9*(4), 145-155.

[5] Mohapatra, H., & Rath, A. K. (2021). Fault tolerance in WSN through uniform load distribution function. *International journal of sensors wireless communications and control*, *11*(4), 385-394.

[6] Mohapatra, H., & Rath, A. K. (2020, October). Nub less sensor based smart water tap for preventing water loss at public stand posts. *2020 IEEE microwave theory and techniques in wireless communications (MTTW)* (Vol. 1, pp. 145-150). IEEE.

[7] Mohapatra, H., & Rath, A. K. (2022). IoE based framework for smart agriculture. *Journal of ambient intelligence and humanized computing*, *13*(1), 407-424.

[8] Mohapatra, H., & Rath, A. K. (2021). A fault tolerant routing scheme for advanced metering infrastructure: an approach towards smart grid. *Cluster computing*, *24*(3), 2193-2211.

[9] Mohapatra, H., & Rath, A. K. (2021). An IoT based efficient multi-objective real-time smart parking system. *International journal of sensor networks*, *37*(4), 219-232.

[10] Mohapatra, H., & Rath, A. K. (2019). Fault tolerance through energy balanced cluster formation (EBCF) in WSN. In *Smart innovations in communication and computational sciences* (pp. 313-321). Springer, Singapore.

[11] Panda, H., Mohapatra, H., & Rath, A. K. (2020). WSN-based water channelization: an approach of smart water. In *Smart cities—opportunities and challenges* (pp. 157-166). Springer, Singapore.

[12] Mohapatra, Hitesh; Rath, Amiya Kumar: 'IoT-based smart water' [Control, Robotics & Sensors, 2020], 'IoT Technologies in Smart Cities: From sensors to big data, security and trust', Chap. 3, pp. 63-82, DOI: 0.1049/PBCE128E_ch3, IET Digital Library. https://www.amazon.com/IoT-Technologies-SmartCities-security-Robotics/dp/1785618695

[13] Mohapatra, H. (2021, September). Socio-technical challenges in the implementation of smart city. *2021 international conference on innovation and intelligence for informatics, computing, and technologies (3ICT)* (pp. 57-62). IEEE.

[14] Mohapatra, H. (2020). Offline drone instrumentalized ambulance for emergency situations. *IAES international journal of robotics and automation*, *9*(4), 251-255.

[15] Mohapatra, H., & Rath, A. K. (2020). *Fundamentals of software engineering: designed to provide an insight into the software engineering concepts*. BPB Publications.

[16] Mohapatra, H. (2021). *Designing of fault tolerant models for wireless sensor network* (Doctoral dissertation, Ph. D Dissertation, Veer Surendra Sai University of Technology). Retrieved from http://hdl.handle.net/10603/333160

[17] Mohapatra, H., & Rath, A. K. (2020). Social distancing alarming through proximity sensors for COVID-19. *Easy chair*, *18*. https://wvvw.easychair.org/publications/preprint_download/dMGk

[18] Mohapatra. H. (2021). Smart city with wireless sensor network, ISBN-13: 979-8791261380, KDP, 2021.

[19] Mohapatra, H. (2018). *C Programming: practice.cpp*. Independently Publisher.

[20] Mohapatra, Hitesh; Rath, Amiya Kumar, 'Smart Bike Wheel Lock for Public Parking', Application Number: 336834-001.

[21] Mohapatra, H., & Rath, A. K. (2020). Advancing generation Z employability through new forms of learning: quality assurance and recognition of alternative credentials. DOI: 10.13140/RG.2.2.33463.06560

[22] Mohapatra, H. (2009). *HCR using neural network* (PhD's Desertion, Biju Patnaik University of Technology). Retrieved from https://www.academia.edu/29846341/HCR_English_using_Neural_Network

[23] Mohapatra, H. (2019). *Ground level survey on sambalpur in the perspective of smart water* (No. 1918). Retrieved from https://easychair.org/publications/preprint/CWpb